Kitware

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Summary

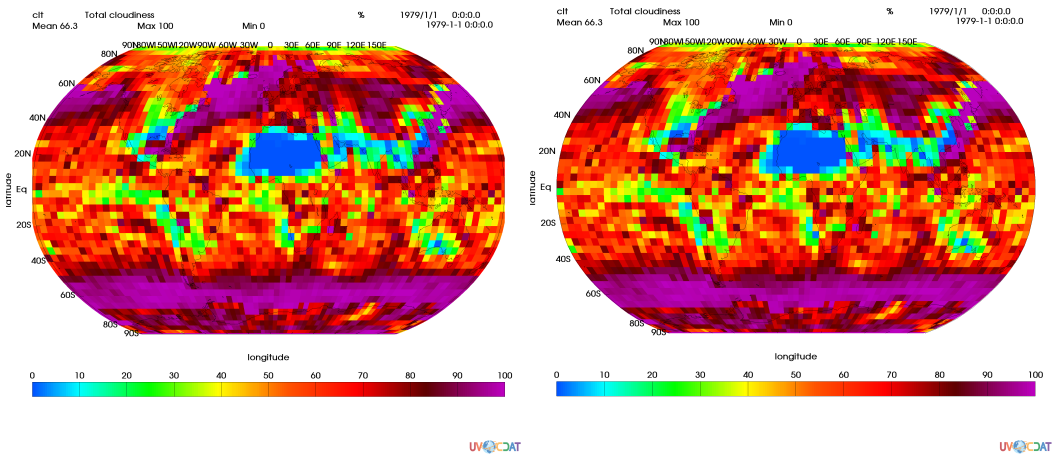
The work done during this year includes enhancement and bug fixes to CDAT, the development of software infrastructure necessary for CDAT testing and CDAT documentation improvements. Below is the list of tasks completed in each category.

Bug fixes and enhancements to CDAT

- Blank spots on solid fillareastyle with fillareaindices. The solid fillareastyle was treated as a pattern style in that each level was extracted and rendered individually. Because of a bug in vtkBandedPolyDataContourFilter this results in blank spots. In this fix we trigger merging of levels which fixes the problem for solid fill.
- Wrong dataset created from nc file with decreasing lat and bounds. We did not handle correctly a nc file which specifies bounds and has decreasing latitude or longitude. Added test for this problem.
- Computing geographic projection bounds uses open interval. Inside VTKPlots.fitToViewport the geographic projection bounds is computed by generating a 2D array of points inside the original data and then doing a geo projection. The problem was that the array of points was using an open interval using the original data bounds, so it was missing the last values.
- Proj4 wraps longitudes to -180,180. We pass two additional options to proj4 +over to not wrap longitude values, +lon_0 to set the central meridian
- Fix plot wrapping issues with patterns/hatches
- Fix animation of projected plots
- Fix plotting for projected plots for invalid values
- Fix VTK bug related to geo-transformation
- Add patterns/hatches support for boxfill and meshfill plots.
- Add support for line stipple patterns and line widths for isoline plots
- Support for Xcode version 7 (OS X 10.10 and higher)
- Worked towards updating PROJ4 version in VTK
- Use dataset bounds when computing parallel projection for plots instead of recomputing these bounds using a 2D array of plots. This fixed long standing alignment issues for

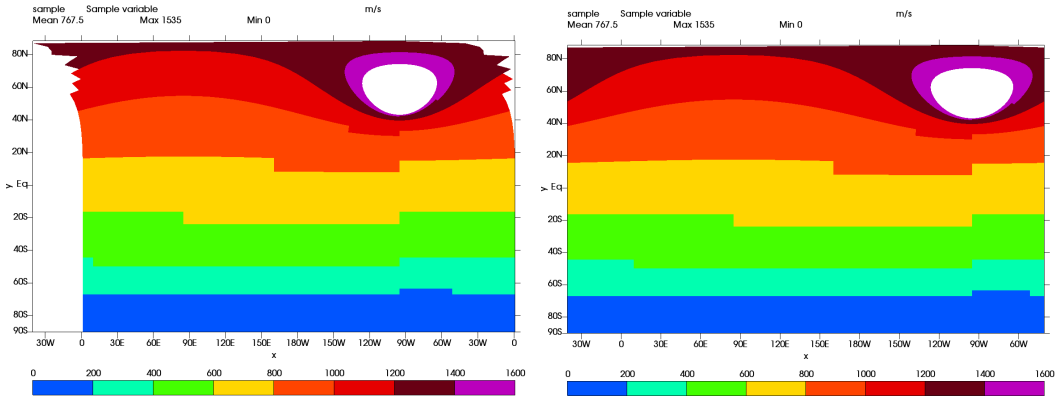
plots that use geographic projections. With this change, we improved images for 63 tests similarly with the images included at the end of this paragraph.

- BUG #1739: fitToViewport uses dataset bounds instead of recomputing them
  fitToViewport recomputes the dataset bounds using an 2D array of points. This is slow and imprecise and it does not take into account the bounds stored in the file. Now we use a new function fitToViewportBounds that receives the dataset bounds as parameter. The old function is still used for the outline and the continents. It is going to be removed in the future.
- BUG: use fitToViewportBounds for outline and continents.



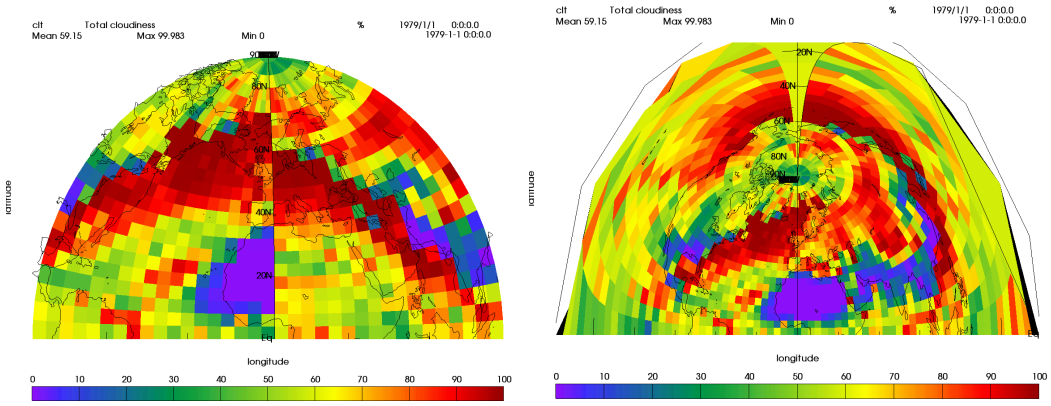
Boxfill plot with robinson projection. Images before (left) and after (right) our fix. We improved images for 63 tests in a similar fashion.

- Wrapped meshfill grids. This enhancement improved plots for curvilinear grids that are cut along irregular lines.
  - ENH #1754: irregular cuts are not wrapped.
    sampleCurveGrid4.nc data is cut along an irregular line (not along a longitude line). This causes lon data to vary between -40 and 361. We wrap this data to the -40,320 interval. In general we wrap data to the interval minX,minX+360 where minX is the minimum longitude value. This fix improved images for 36 tests similarly with the images included in this paragraph.



Meshfill with linear projection. Images before (left) and after (right) our change. We improved images for 36 tests in a similar fashion.

- Update uvcdat to use latest VTK and proj4.9.2. This improved plots using aeqd projection and fixed system dependent bugs for certain projections. This change improved images for 53 tests for AEQD projection similarly with the images at the end of this paragraph. Note, that these plots require more work to add more points for outlines and better place labels.
    - Update script for ThirdPary/libproj4
      Changes to proj4 are stored at
      https://gitlab.kitware.com/third-party/proj.git in for/vtk branch.
      The update script is run to move those changes into
      ThirdParty/libproj4/vtklibproj4
    - Remove all proj4 files to start fresh.
      proj4 is updated from a very old source for which there is no repo online. We remove all files to start fresh on a recent proj4.
    - Fix Geovis tests. Projections numbers changed in proj 4.9.2
      We used a very old proj (4.3.2 from 2008?). Since then
      projection indexes have changed. Projection indexes are used
      to select the projection for vtkGeoProjectionSource.
      So, while it is possible to convert between a projection index to a projection name, the projection index might change for future versions of proj4.
    - Enable vcs_test_lambert on Mac Os X.
    - GL2PS uses a different class and module.



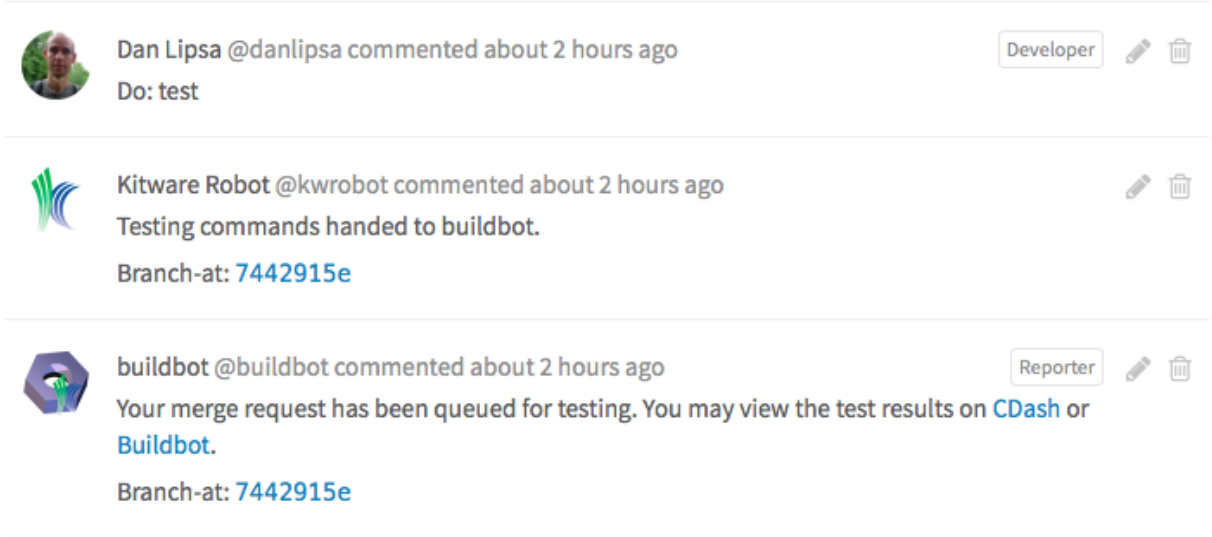
Boxfill with AEQD projection. Images before (left) and after (right) our upgrade. More work is required to smooth outlines and better place labels. We improved images for 53 tests in a similar fashion.

- Fixed in VTK, system dependent crash and mangled image for the lambert projection.
  - BUG: push_back may cause pointers to become invalid
    Pointers to strings stored in a vector are kept, however new strings are added using push_back which causes the pointers to become invalid. This behavior was only seen on mac os as the vector was small so reallocation did not happen on other platforms.
  - BUG #1777: lambert test creates mangled up image
    vtkGeoProjection initialized a new projection for every GetProjection call. This created a lot of allocations/deletes which probably exposed memory problems in proj4.
- Fixed plot resize issue with cdat-web
  - BUG cdat-web #78: VTKPlots.configureEvent is not called
    A handler for ModifiedEvent is added to the interactor which is replaced by vtkWeb. A new handler is added on render window.
- Miscellaneous bug fixes and enhancements:
  - BUG: proj4 over option causes problems with polar projections
    On certain machines, +over option to proj4 results in wrong projections. It is not clear why there is a difference between different computers - we have seen this behavior on both unix and mac. +over does not wrap points outside of -180, 180. To fix those machines we remove the option for polar projections.
  - Refactor computation for the bounds of an axis.
  - BUG: Set wrong lat_0 for -3 polar (non gctp) projection. Fail to recognize that ym,yM are not the min/max for axis Y, but just the bounds for this axis.

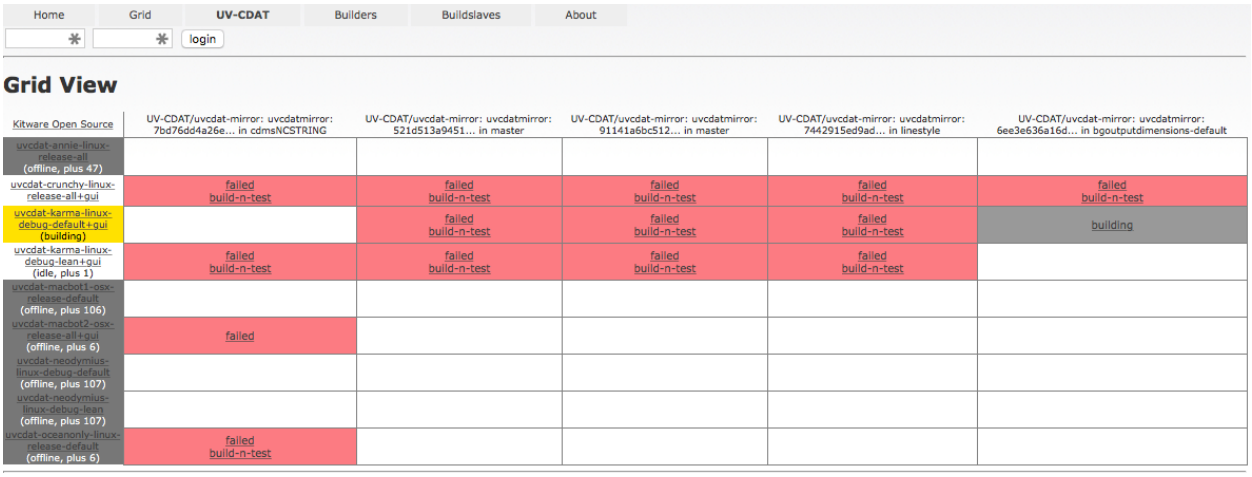
- Rename xm, xM, ym, yM to x1, x2, y1, y2 for project. Those are margins for increasing or decreasing sequences not bounds. So m is not less than M as suggested by the previous notation.
- BUG #1812: Fix taylor cutoff. The generated data file was missing the top and right side because loops using right open interval were used to generate data: [v1, v2)
- Add test for BUG # 1728: wrapping data creates long cells.
- BUG #1849: Re-enable datawc for linear projection. For datasets using a geographic projection, datawc is only used to specify wrapping (translation of the origin, for instance from 0:360 to -180:180) and flipping.
- BUG: calling render() from ModifiedEvent causes GetSize() to return previous size. This causes test_vcs_configurator_resize to fail.

Continuous integration and testing system

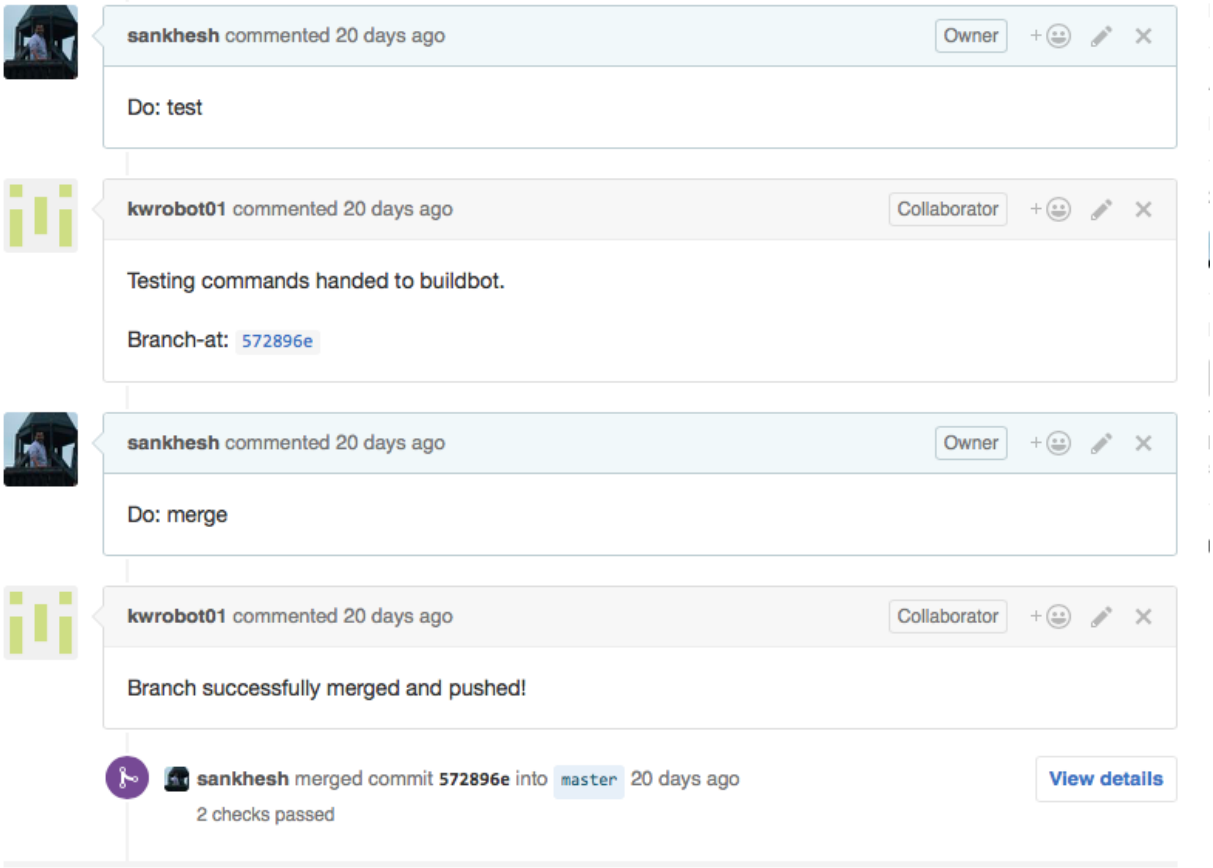
- Add build slaves to listen to merge requests on https://gitlab.kitware.com/UV-CDAT/uvcdat
- Port existing git robot to work with with Github and buildbot
- The git robot would listen to changes, pull requests, etc. on Github and trigger test builds as needed
- Add support for buildslaves at LLNL and Kitware
- The whole testing infrastructure works on Gitlab. Pull requests from Github are ported as merge requests.
- Users type commands like 'Do: test' as comments on the merge request to run the test suite on multiple build slaves.



- Build slaves deployed at LLNL and Kitware



- Github integration with GitRobot complete. Tested.



- Existing buildbot ported to work with Github. Testing revealed some bugs that need to be fixed.

CDAT documentation improvements

- Created new documentation for vcs and uvcdat.
- Updating documentation to include deep-down details of VCS api.